

Influence of silanization and filler fraction on aged dental composites.

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Abstract

The effect of silanization and filler fraction on the mechanical properties of aged dental composites was investigated. Experimental composites (75/25 Bis-GMA/TEGDMA resin reinforced with 0, 12.6, 30.0, and 56.5 vol% 8 microm silanized/unsilanized BaSiO₆) were fabricated into 4.7 mm diameter x 2.2 mm thick discs and 3.5 mm diameter x 7.3 mm thick discs for diametral tensile and compressive tests, respectively. The effect of immersion in 75% ethanol at 37 degrees C for 0-30 days on the diametral tensile strength (DTS) and compressive strength (CS) of the samples was evaluated and analysed by ANOVA and Tukey LSD test. The fracture interface between filler and resin matrix was then examined by scanning electron microscope. Results and subsequent statistical evidence from DTS (18.6±7.6 MPa, silanized versus 11.7±2.6 MPa, unsilanized) and CS (85.1±29.7 MPa, silanized versus 56.0±11.3 MPa, unsilanized) strongly implies that silanization may greatly enhance the mechanical properties of the resin composites. Furthermore, it also shows that both DTS and CS increased proportionally as the filler fraction of the composites increased. However, in the unsilanized groups, DTS decreased (up to 40%) as the filler fraction increased, and CS showed no relevance to the filler fraction at all. As for the influence of aging, it was found that both DTS and CS showed a significant decrease after immersion in 75% ethanol, and silanization heavily correlated with the filler fraction of aged-resin composites. Microscopic examination of the fractured samples showed that failure primarily occurred within the resin matrix per se for silanized composites and adjacent to the filler particles for unsilanized composites. All the evidence points to the conclusion that mechanical properties of aged-resin composites can be greatly influenced by silanization and the filler fraction.